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# **Motives for and barriers to household adoption of small-scale production of electricity: examples from Sweden**

## **Abstract**

A new concept for small-scale electricity production attracted massive media attention in Sweden in 2008, when companies began marketing small-scale photovoltaic panels (PVs) and wind turbines to households. Their main selling point is simplicity: the products are so easy to install that anyone can do it. How, then, do households perceive these products? Why would households choose to buy them? What do households think about producing their own electricity?

Analysis of material from in-depth interviews with members of 20 households reveals that environmental concerns are the main motive for adopting PVs or micro wind turbines. Some adopting households have an ecologically aware lifestyle and such adoption represents a way to take action in the energy area. For others, this investment is symbolic: a way of displaying environmental consciousness or setting an example for others. For still others, the adoption represents a protest against “the system”, with its large dominant actors, or a way to become self-sufficient. The main reasons for rejecting these microgeneration installations are financial; other reasons are respect for neighbors and difficulties finding a place to install a wind turbine.

## **Introduction**

Renewable energy technologies, such as wind turbines and solar cells, are seen as key to any solution to the problem of climate change. These are sustainable technologies that can be used in the future without irreversibly damaging the earth’s ecosystem. The Kyoto Protocol includes a directive that all ratifying states should introduce more renewable energy production into their

energy systems. The EU Commission has prioritized energy issues and set the “20/20/20” goals: to obtain 20% of the EU’s overall energy mix from renewable sources, reduce total primary energy consumption by 20%, and cut greenhouse gas emissions by at least 20% (all relative to the 1990 baseline)—by 2020 (EC Directive 2006/32/EC; SOU, 2008:25). Other policies to encourage renewables include the use of green certificates, a tradable commodity proving that certain electricity is generated from renewable energy sources (SOU 2008:25).

The rapid development of renewable energy technologies seems vital. These technologies, however, face the problem of becoming established on the market (Elliott, 2000). The present article focuses on small-scale electricity production in Sweden, i.e., systems whereby households can buy grid-connected photovoltaic panels (PVs) and wind turbines and connect them to their household electricity systems.

This article analyzes household decision-making regarding the adoption of small-scale PVs and wind turbines. We will discuss motives for and barriers to household adoption of these microgeneration technologies and how households perceive them. What do households think about producing their own electricity and what barriers and enablers have they experienced?

The paper first discusses earlier research into user adoption of green innovations, specifically PVs and micro wind turbines. Thereafter we briefly describe the Swedish market for PVs and wind turbines and then the field study on which this paper is based. The results of interviews with households in different stages of the decision-making process regarding the adoption of PVs and micro wind turbines are then presented. Finally, we offer conclusions concerning various motives for and barriers to household adoption of these technologies.

## **Household Motivation for Adopting PVs and Wind Turbines**

Geels et al have discussed how radical novelties develop in established sociotechnical systems, such as the electricity system. In this model radical novelties are developed in special spaces, technological niches, where they are sheltered from mainstream competition (Schot & Geels, 2008). That can be small market niches, that will be the case here, or technological niches, where resources are provided by public subsidies. Niches need protection because new technologies initially have low price/performance ratio. Small networks of actors are giving protection for the niches, so when initiating new technology building social networks are a vital part (Verbong & Geels 2007). Niches form the micro-level where radical novelties emerge. The meso level is the regime level including routines, knowledge, defining problems and so on imbedded in institutions and infrastructures. The macro level is the socio-technical landscape which is the environment that changes slowly (Geels & Kemp, 2007). Verbong and Geels (2007) describe the relationship between the three levels: niches, regimes and landscape, as a 'nested hierarchy'. New technologies have problems to break through because of established regimes that are deep-rooted. Transition only takes place when all three levels link up and reinforce each other. The sociotechnical regime forms the meso-level, which accounts for the stability of existing large-scale systems, such as energy systems. The macro-level is formed by the sociotechnical landscape, and cannot be under direct influence of niche and regime actors. Changes in the landscape level occur slowly. Niche actors hope that novelties eventually will be used in the regime. Niche actors can contribute to changes in practices and routines of existing regime actors (Schot & Geels, 2008). A socio-technical regime is characterized by the set of rules that guide technical design, as well as rules that shape market development such as user preferences and rules for regulating these markets (Schot & Geels 2007).

In our case the niche actors are the small companies that launch the concept of small-scale electricity production. To success they need to enroll early adopters to their network. Spaargaren (2000) discusses the perspective that individuals choose what products to consume within particular social arrangements and not in isolation; consumption thus must be seen in its social context. Spaargaren and van Vliet (2000) claim that people seek to realize the partial integration of green practices into their daily lives. Actors prefer to bind their various social practices into a reasonably coherent unit. When a householder embraces a green lifestyle, this corresponds to a life story in which the actor is expressing who s/he is or wants to be; the life story serves to express this person's identity and self narrative. From this perspective, "lifestyle" is the degree of coherence found in a person's behavior, though modes of action in one context may differ from those adopted in others (Spaargaren, 2003).

Rohracher (2003) discusses how consumers may communicate various meanings and lifestyles through their product purchases. PVs and wind turbines offer the opportunity for individuals to make statements about their environmental beliefs. Earlier studies have demonstrated that the environment is becoming increasingly important as a symbolic issue. People want to show that they are environmentally aware and think about climate problems (Pedersen, 2000; Hedrén, 2002, 2009; Skill, 2008). Investing in a fully-visible PV or micro wind turbine can be a symbolic way for households to communicate their values to others in their communities.

Kaplan (1999) has studied the process of PV adoption. He found that, aside from knowledge of the existence of PVs, motivation, technical understanding, experience, and familiarity (e.g., whether the household had previously installed a similar technology, such as solar heating) were other critical factors to be considered.

Faiers and Neame (2006) consider whether early adopters develop internal reference prices based on their knowledge and competence. In other words, the actual cost of an innovation is unimportant; what matters is what it is worth to the adopters as individuals. At the same time, however, earlier studies have detected inconsistencies in the green consumption area; for example, consumers who recycle materials do not necessarily favor green energy products (Faiers & Neame, 2006). In this context, Spaargaren (2000) has emphasized that consumers' involvement in greening their lifestyles and domestic consumption patterns concerns more than how much money they want to spend in specific ways. Additional aspects, such as material, social, and cultural efforts and rewards, come along with certain innovations. Sometimes people develop bottom-up forms of greener self-provision and want to be independent from the utility company; in other cases, people simply want to be served, even though more sustainable arrangements are available (Spaargaren, 2000).

Shove et al. (2007) have discussed how some practitioners also enjoy the *process* inherent in do-it-yourself activities or craft consumption. Rather than focusing on demonstrating one's economic capacity by owning and showing off expensive consumer goods, people are engaged in demonstrating their *abilities* as competent practitioners (Röpke, 2009).

Our analysis focuses specifically on household motivation for and barriers to considering and possibly adopting PVs and wind turbines. The interviewees articulated an identifiable set of motives and barriers regarding the adoption of PVs and small-scale wind turbines. As we will see in the householders' argumentation, these are related to a willingness to uphold and mediate a green lifestyle.

Before presenting the household interview results, we will briefly outline the Swedish market for small-scale electricity production and then introduce the case study.

## **The Swedish Market for PVs and Wind Power**

The market share of PVs and wind power in Sweden today is not large. At the end of 2006, installed wind power capacity was 580 MW, representing only 1.7% of total installed capacity (SEA, 2009), while PVs had an installed capacity of only 5 MW (IEA PVPS, 2008). The market is expanding, however, and the installed capacity of PVs grew faster than ever in 2007 while that of wind power grew as well.

In Sweden, a “new” concept of small-scale electricity production, launched by companies such as Egen El and Home Energy, attracted massive media attention in 2008 (Palm & Tengvard, 2009). These companies market small-scale PVs and wind turbines, allowing households to buy power plants that are easy to install and connect to one’s house. What is new in this concept is how it is marketed: as something designed for ordinary people. According to Egen El’s website, their products are so easy to install that anyone can do it without expert help. While the concept launched by Egen El builds on the notions of simplicity and that no expert help is needed, Home Energy, in contrast, provides free installation of its products. The systems from Egen El and Home Energy include transformers, meaning the electricity produced can be directly accessed from a standard electrical outlet.

Both companies emphasize that building permits are not required to install either their PVs or wind turbines.

To get a picture of the market for microgeneration systems, we interviewed seven PV and micro wind turbine retailers who target households. The household members we interviewed had bought products from three of these retailers, whose studied products are presented in Table 1.

**Table 1** Retailers of PVs and micro wind turbines whose products were purchased by the studied households

| Company     | Product   | Inquiries and number sold to households in October 2008   |
|-------------|---|---|
| Egen El     | Balcony PV: 300 W, EUR 2700<br>PV: 540 W, EUR 4400<br>Wind turbine: 1000W, EUR 5000<br><br>Installation not included; no building permit needed   | Inquiries: 847<br>Sold: 30<br>50/50 split between wind turbines and PVs   |
| Windon      | Wind turbine: 10 kW, EUR 25,000<br><br>Installation included; municipal building permit needed  | Inquiries: 12,000–13,000<br>Sold: nine  |
| Home Energy | Wind turbine: v100 350–600 kWh, EUR 4–4500<br>Wind turbine: v200 700–1200 kWh, EUR 9–9500<br><br>Installation included; no building permit needed | Inquiries: statistics unavailable<br>Sold: v100, one to a homeowner, seven to companies; v200, seven to companies |

The niche of the third studied company, Windon, is larger wind turbines, but households (in rural areas) are still their main customers. For its lower-priced products, Windon helps household purchasers negotiate contracts with installation companies, while systems costing over EUR 25,000 include installation. Egen El and Home Energy source their products from external manufacturers, while Windon has developed its own wind turbines.

The interviews with representatives of these companies are not the focus of this paper. Briefly stated, however, these companies saw cost as the major factor keeping households from adopting their products. The interviewed manager from Home Energy also said that customers often have difficulties understanding the amount of electricity these plants actually produce. Even though the company provides exhaustive information on production capacity, customers often become disappointed when they discuss the matter in depth with a sales representative. This is generally



the first time they realize they will be able to produce only a minor amount of the electricity needed to supply their household's total needs. The decision-making process often ends then, as the households rethink the investment.

We also interviewed a representative of IKEA Greentech, and we will briefly mention the results of this interview here. One goal of IKEA Greentech (founded, 2007; active, spring 2008) is to market solar panels in IKEA stores within three years. To achieve this, IKEA has invested EUR 5,000,000 to reduce the cost of solar cell production by 70–80%. IKEA will not start its own production; rather, it will invest in an existing company that produces solar cells.

## **Methods and Materials**

The main research method used was semi-structured in-depth interviews (Kvale & Brinkman, 2009). We interviewed representatives of seven retail companies, five grid companies, the industry organization Swedenergy, IKEA Greentech, and 20 households (i.e., 22 householders). The article focuses on the interviewed householders who live in individual houses and apartments throughout Sweden. They were contacted by the managers of the studied companies and asked whether they wanted to participate in the study; then, either the willing householders contacted us directly or we got their names and phone numbers from the managers. We usually interviewed one family member per household, but on two occasions two adults were present. We normally contacted and interviewed the family member listed in the information we got from the retailers; in some cases, however, the households chose a different adult family member to participate instead of the listed one.

The interviewed householders were in different phases of the decision-making process, some having already decided whether or not to adopt the technology while others were still seeking

information about their options. At the time of the interviews, nine households had bought a plant, eight households were still considering buying, and three had decided not to buy a power plant. Of the nine households that had bought a plant, five had installed the systems when we interviewed them.

As mentioned, the interviews were semi-structured and we used an interview guide (Alvesson & Sköldbberg, 1994) covering the following matters: 1) background data, 2) first contact with the concept of small-scale electricity production and why the households are interested, 3) barriers to and enablers of product adoption, 4) information received on the various studied products, 5) pros and cons of various studied solutions, 6) decision made or what decision-making stage they are in, and 7) energy use—awareness and efficiency measures implemented.

The interviews were recorded using an MP3 recorder/player and then transcribed. The interviewed householders are anonymized in this paper and will be simply referred to as householders 1–20; when two members of a single household were interviewed, this is indicated by appending “a” or “b” to the householder’s number.

The householders were 30–75 years old. The average household income was EUR 60,000–70,000 per year. Most interviewed householders had university degrees. Three households lived in rental apartments and 17 in self-owned homes. Their total consumption of electricity and heat varied greatly, from 3000 kWh to 30,000 kWh per year.

When analyzing the material, we will discuss various perceptions that the households have of their energy use and of the stated motives for and barriers to adopting small-scale electrical production plants. Using an inductive method, we scanned the empirical material from the

householder interviews to identify categories illustrating the various stated motives for and barriers to adopting such small-scale renewable technology. While a household might express negative or skeptical opinions about such plants, it might even have made the investment or still be considering it. In fact, and as shown above, at the time of the interviews only three households had definitely decided *not* to buy, while eight were still considering the pros and cons, which will be illustrated in these categories.

## **Motives for and Barriers to Householder Adoption of Small-scale Electricity Production**

An overview of the expressed household motives for adopting, rejecting, or delaying an investment in small-scale energy production will be presented in this section. We have categorized the material according to the main motives identified in the interviews.

### ***Motives for adoption***

Six more or less interrelated motives were cited in the interviews, and these will be discussed below.

#### ***Concern for the environment and harmonization with the lifestyle***

“It is the environment, we must think about it” (householder 8) – this was emphasized by most interviewed householders. Many emphasized the importance of living in harmony with nature, including living as ecologically sustainably as possible in all everyday activities. This included avoiding long-distance travel and saving energy “fanatically.” Producing one’s own electricity was an important part of this sustainable way of life:

To me, it's quite clear that we should not leave "ecological footprints" on the earth, but treat the environment with respect and dignity. Not steal resources from others but use what is given to us. This is a fundamental value for me. (householder 3a)

This notion was shared by several householders who saw the investment as an important part of a lifestyle they wanted to uphold and mediate. Householder 17, for example, elaborated on the subject in greater detail. This householder considered buying a wind turbine and believed this would be in harmony with the family's way of life:

In our family we discuss what we eat, who produces the food we eat, and all these things. We have had this environmental concern all our lives. We are members of Greenpeace and the Swedish Society for Nature Conservation and so on. (householder 17)

*Own production as a way to act and to set an example for others*

Investing in a small-scale power plant was a way to act, to do something. Householder 3a, who has invested in PV panels, described the investment this way: "To me, it's like a manifestation of the thought." Householder 9, who was considering investing in a solar panel, said, "It would just feel good, like you would actually be doing something."

For other interviewees, it was obvious that the investment was a social act and the emphasis was on its symbolism. It was a way to show neighbors and friends that it is possible to act and do something, even as an individual. Householder 5, who was thinking of investing in a balcony-mounted PV panel, expressed it in these terms:

If other people see that I have bought a [micro power] plant, then maybe they will follow my example. This way I can help spread the concept of producing one's own electricity and perhaps make it more common in the future.

The investment was a way to set an example for others, and a way to exercise “consumer power”. A common thought was that, if household demand for micro power plants that produce environmentally friendly electricity grows steadily, eventually there will be a smaller market for non-renewable alternatives sold by contemporary electricity companies.

*As a way to protest against energy companies or the “Big Brother” society*

Producing their own energy was a way for the households to distance themselves from the energy companies and contribute to producing clean, green energy.

The choice to go ahead and produce my own energy is also a way to take a stand against the big electricity companies and the dirty energy they produce. It's sort of like “No, I just won't have that!” (householder 4)

The investment was a kind of protest against the Swedish system, with its large energy dominant actors: “It would be fun to score points off Vattenfall [a major Swedish energy company]” (household 6). Householder 8 said that his dream was to be completely disconnected from the grid company (cf. Spaargaren, 2000). Others saw their micro power investment as a statement against the whole societal system:

Just to fight the “Big Brother” society. Definitely. Both Swedish and international power production and distribution are unfair, monopolistic, and counterproductive. The enterprises do not work in the interest of the people, but to earn money. (householder 1a)

Other households were more careful in their statements; for example, householder 9 said that he just wanted to “annoy” the grid companies:

They are using our lifestyle in a speculative way that results in these big companies earning a lot of money from how we live and use our energy.

This he sees as very negative and something that producing one’s own electricity can help put right.

#### *Own production as a way to become independent*

For some respondents who live in the country, a major reason for investing in a micro power plant was the possibility it afforded of using the natural resources present in their everyday surroundings to produce energy. This was an option they considered both logical and practical. Householder 12, who had decided to buy a plant and install it near his house in the archipelago, expressed it in these terms:

Since I have my own land with extensive access to wind and sun, then, to me, it seems sensible to produce my own electricity. It’s sort of like catching your own fish or growing your own potatoes. I find that

awesome – it would make me more self-sufficient and I like the thought of that! (householder 12)

Thus, producing one's own energy was also linked to becoming more self-sufficient. In fact, many households stressed the benefits of becoming more independent and less vulnerable in case of temporary power failure or even in the event of *force majeure* or longer periods of blackout:

“I could handle a long-term siege using wood and this turbine” (householder 8).

On the other hand, some household interviewees emphasized that a benefit of the chosen micro power systems was that one was still connected to the grid in case something should happen to one's power plant. Others described the advantages in terms of wanting to exercise more control over their own energy situation.

#### *Financial reasons*

The aim of being completely energy self-sufficient was articulated by some households. At present, the Swedish state is investigating whether it should be easier and cheaper for individuals to sell the electricity they produce back to the grid, a practice so costly today that it is not feasible for small-scale producers such as those studied here. Most households expect a change in legislation that will benefit small-scale producers; this is something that householder 14 awaits:

What is so good about this [system] is that you can just send the electricity that you don't use back to the grid. I get more out of it that way. Like in the summertime, you don't use that much electricity anyway and then I might just as well sell it back ... And then, maybe in

ten years from now, it will be like a form of retirement pension. But for now, I'm waiting for parliament to decide what's going to happen.

Although most respondents, unlike householder 14, expressed no plans to earn money from producing energy, some still had financial motives. In the long run, the investment might pay off as electricity prices increased, they reasoned. In addition, new legislation is expected to make it easier for private individuals to be compensated for the surplus electricity they deliver to the grid. The expectation is that the cost of measuring the electricity delivered by small producers to the grid also will decline substantially, so that it will be more beneficial for them to produce more electricity than needed for their domestic use. Many households would welcome this as an extra incentive to invest in micro power plants. In addition, some interviewees said that this would enable them to invest in *more* power plants, which suggests that economic factors are not insignificant.

Others were more pragmatic and stated that, from a financial perspective, the investment was not viable: "I probably have the most expensive electricity bill in this neighborhood" (householder 2), due to the high investment cost of the wind turbine. This householder also noted that it was hard to make the calculations connected with the investment, because this entailed estimating the future electricity price—an impossible task, according to many householders. The householders also said that they would rather invest in PVs and wind turbines than in other luxury consumption items, such as swimming pools (an often-cited example). Householder 16 compared buying a PV panel to buying a Mercedes, linking this with status and the symbolic aspects discussed above:



Why do people pay extra for expensive cars? You buy a BMW or a Mercedes because you want to show something: you pay an extra 50 000 kronor [EUR 5 000] for that ... Same thing with PV panels: in California they're proper status symbols that show that you've got money. And in Germany, they say, "Why don't you have PV panels on the roof? Haven't you realized how good they are?" Next to your Porsche you've got to have solar panels on the roof, otherwise you're not quite right in the head. Either you are not smart enough to know how good this is, or you are not environmentally aware enough or in tune with the times.

### *Technological reasons*

A final factor cited by the householders concerned the technology and the functioning of the power plant itself, namely, the delight of actually producing one's own electricity. Many householders claimed that being able to produce their own electricity was a "fun" concept. They enjoyed watching their electricity meters indicating the kW they produced themselves.

The Egen El and Home Energy concepts appeal to people interested in new technology without being experts in the area. Some said that they would never invest in a "real" PV panel because they were too technically complicated. The systems provided by these companies are easier to understand, install, and operate, according to the householders: once the plants are plugged in, they do not have to maintain them, only watch them produce energy.

### ***Barriers to adopting small-scale production plants***

When we asked all the households about their reasons for rejecting or at least postponing the investment, we got four more or less interrelated arguments.

### *Investment costs and production efficiency*

The most often-cited hindrance was the high up-front cost of the power plants and the low production efficiency in relation to price: “EUR 4000 for a solar panel is very expensive per kilowatt hour. For people working with energy, this idea is probably quite stupid,” said householder 16, who eventually invested in a PV. He thought that the energy companies evaluated the energy system on a different basis compared with households, and that the company only saw that it was irrational to invest so much money for so little output.

Another householder, who was delaying buying a microgeneration product, said, “If you lose some money, that is no big deal, but this is very expensive” (householder 6). Another interviewee, householder 15, decided to buy shares in a local wind energy project:

The biggest disadvantage is the investment cost. To get a system that will produce any [practical amount of] electricity you will need to spend 5000 Euros and even then it will not produce many kWh per year. The investment is simply too big and the pay-off time too long for me to dare to go for it.

As well, householder 10 calculated that the cost would be double that of buying shares in a community-owned wind farm. Householder 8 bought wind shares because he realized that he would need five turbines, and somewhere to put them, to supply his family’s electricity needs. Other households thought that calculating pay-off time and the like was impossible or at least very uncertain, because it is impossible to estimate the future electricity price.

### *Grid companies and regulations as a hindrance*

A problem emphasized by several householders is that the big energy companies have a monopoly on the grid and determine the connection fees. They thought that the grid companies were trying to hinder the installation of new net meters and that, by not giving clear answers, they were prolonging the permission process:

They cannot give a straight answer but refer to various paragraphs. It is very unclear ... it is hard to move on in the process. (householder 17)

Furthermore, the householders felt that the offered micro power concepts were so new that the authorities had yet to develop a tradition for handling the connection issues. Householder 19 described it thus:

Because this is a so-called pilot plant, there are many decision-makers in both the municipality and the grid company who do not know how to respond when you ask something or apply for a building permit.

This householder felt that both the grid company and local authorities were major hindrances that slowed the spread of microgeneration.

### *Finding a place to locate the wind turbine without risking relations with neighbors*

Some households said that the major hindrance was finding good locations for wind turbines; as householder 17 said:

Finances are not a problem for us ... The problem is that the turbine needs to be installed near an electrical outlet. At the moment we can't see such a suitable place here. The most suitable location for us is several hundred meters away from an outlet. And if we put it on the roof, yes, then the mast will be really, really high. So right now we don't know what to do.

The other problem was that the wind turbine could not be placed where the mast could fall into the neighbor's garden, which for householder 8 meant that it could not be placed in the best location according to the wind test. This householder could have placed the two-meter-tall mast on the roof, but the woman in the household objected and said that this would be disrespectful to the neighbors. The couple lives in an environmentally protected area in the middle of a village; the neighbors would see the wind turbine as "visual contamination," she said. The male householder 8 said:

It is all about respect for your surroundings. It would have been very visible. People would have noticed and reacted to it.

The studied households that bought shares in wind cooperatives, like householder 8 (above), all mentioned respect for neighbors as an important factor influencing their decision not to buy their own microgeneration system but to invest in a cooperative instead.

### *Technology and installation*

The technology itself was also viewed as a hindrance. Household 1 emphasized that, from a consumption perspective, it was disadvantageous to buy a product when it was new on the market, even for a good cause:

It is a gadget. There is anxiety that it is there and can fall down and become damaged. What are we supposed to do if something happens?  
(householder 1a)

The households were also concerned that the power plants would need considerable maintenance. In general, the interviewed households were unsure as to whether they would be able to install the products themselves. They also thought that they would need some expert help with the electrical installation:

We would need to install the thing as well, and I am not a handy man and I don't have the time for it either. It must be easy to install and preferably it should work instantly. (householder 17)

As we will discuss below, there were also some problems in the installation process.

### ***The installation process and production results***

As mentioned above, only five households had installed the products. We will summarize their experience of installing the power plants and their electrical output.

Egen El's products are not sold with the installation included. The products are easy to order over the Internet, which the studied households had done. The information they received about both the products and their installation was available on the companies' websites. The description of the assembly process was clear, but some questions arose during installation. For example, some municipalities require a building permit if a wind turbine is to be roof mounted, despite the manufacturer's claim that such permits are unnecessary. The electrical installation was also something the households could not manage on their own, as they lacked specific information about connecting the wires and running the cables. "Try to fiddle with it," advised one company when contacted by a household. Cord lengths and missing parts were also noted as problems. In addition, the households lacked information on how to install the PVs for optimal function. For the wind turbines, raising the mast was difficult, not least because heavy parts had to be lifted high in the air.

## **Conclusions**

We have seen that this niche market overall attract households that manifested strong environmental concern and embraced a "green" lifestyle, which is why they were interested in the microgeneration concept in the first place. The households that the companies enrolled to their network understood climate change and that this would entail changing how energy is generated and used. The householders we studied also wanted to integrate electricity production into a green lifestyle, and self-production represented an alternative to buying green electricity from energy companies. Notably, however, not all households have extensive knowledge of either the energy system or the offered technology: they are interested in the products for other reasons.

If we look at the households that adopted one of the studied products, we can see that their main reasons for this were environmental concern in combination with the fact that the investment gave the householders a “better conscience”; alternatively, the investment was symbolic, offering the householders a way to demonstrate an ecological lifestyle to neighbors and friends. In these cases, the investment relates less to economic rationality than to environmental concern. The investment is also seen as practical or self-explanatory, mainly because the respondents often live in rural areas and have suitable locations for wind turbine installation. They often have a lifestyle that includes self-production or buying locally as many goods as possible; they had long wanted to try the technology, but thought that the “convenient” PV panels sold on the market would be too complex to handle. Egen El’s and Home Energy’s products, on the other hand, were seen as easier to understand and adopt, which gave the households the courage to try them.

For the households still considering buying, the environmental argument was central. Environmental concern was the main reason for even thinking about adoption. Another often-cited motive for this group was to protest against the energy companies. To become independent and less vulnerable to power failure was also a common reason. The main hindrance at the moment was cost, i.e., microgeneration is an expensive solution and that the offered systems have low production efficiency. Another common reason concerned the installation process and whether the households could correctly install the products on their own. Several of the households still considering buying are also awaiting new regulations in Sweden that would make it cheaper to sell self-produced electricity to the grid.

The households that rejected the solutions still think that this investment would be coherent with their desired lifestyle. The barriers to adoption, however, are too high, so they often try to find

other ways to contribute to green electricity production without investing in production plants themselves. These households rejected the small-scale plants for economic reasons, because they had not found anywhere to install them, or because they did not want to annoy the neighbors. In relation to economic aspects, these households viewed this investment as expensive and felt there were economically better alternatives on the market.

Installation was a hindrance in two ways: the households would either have to pay someone else to do it or spend considerable time of their own (often helped by friends). Furthermore, the product retailers have different strategies when it comes to installation. Egen El lets the customers install the products themselves, which is a major hindrance for many households and will probably be a significant factor restraining the sales growth of Egen El products. The products have also had problems winning acceptance at the community level, and some studied households cited respect for neighbors when explaining why they had not adopted wind turbines. Though these households could also see many positive sides to the micro power plants, the disadvantages were felt to be much greater.

For PVs and micro wind turbines to be considered by the broader Swedish population, both financial and institutional barriers need to be reduced. Sweden has long been reluctant to use subsidies to speed up the adoption pace, but in July 2009 the government introduced subsidies for household installation of PVs. This should contribute to a more general interest.

So far the concept has mainly reached out to people in rural areas. To market the wind turbines to urban customer will probably be difficult, because to be efficient the turbine need to be placed rather high up in the air, and at the same time it must be placed so it not risk to fall into the neighbours' garden. Installing a wind turbine in a neighbourhood would not be efficient in an



electricity production perspective, but it could, as we saw, have a symbolic value for the owner. But in rural areas PVs are more suitable.

Another issue to be dealt with to reach the broad public is the regulatory regime; regulations need to be more transparent so that people understand what to expect from existing grid companies when, for example, they want to sell electricity back to the grid. There is also a need for simpler regulations for measuring and selling electricity back to the grid. That would make the financial aspects of the concept more attractive for the customers and also attract those customers that lack ecological motives or an interest in the technology as such. New regulation also need to include security and insurance issues and a clause that force the retailers of small-scale production to be update on and inform their customers about existing rules.

The Swedish market for this technology is still small, and there is no single routine method for marketing such products. One example of this lack is the installation process, which the households are often expected to handle on their own. To reach a general public, there should be established installation routines in which households, when buying the products, are automatically offered professional installation.

Although the amount of electricity produced by such power plants might not be great in the near future, it is reasonable to suppose that they will be more common, not least due to rising electricity prices and greater demand for sustainable energy production. When established actors, such as IKEA, start to distribute solar panels in their stores, this will speed up the spread of this technology in the broader population.

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